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H02K 3/487

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H2A AKF1A AK120 AK121 AK213B AK216B AK304B

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GB 1430756 A

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UK CL (Edition K) H2A AKF1A
INT CL^5 H02K 3/487 3/493

(54) Electrical machine slot wedging system

(57) An electrical machine slot wedging system wherein a conductor (11) is held in place in a slot (2) of the machine by wedge means (1, 3) and a resilient means, e.g. a ripple spring (5), sandwiched between the wedge means and the conductor. The wedge means may comprise two co-operating wedges (1, 3) which taper in opposite directions along the length of the slot. A plurality of separate wedge means axially aligned along the length of the slot may be used.

To allow the force exerted by the resilient means to be determined the wedge means may be retained in the slot by means which permit the wedge means to be urged further into the slot against the force exerted by the resilient means.

An aperture (15) may be provided in the outer wedge (1) to allow insertion of a tool to push the lower wedge further under the outer wedge. (Figure 2)

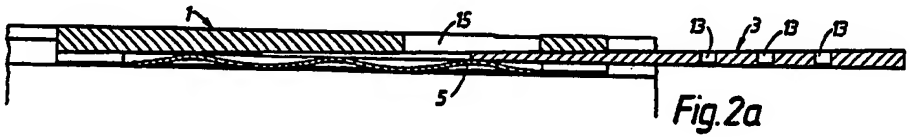

Fig.2a

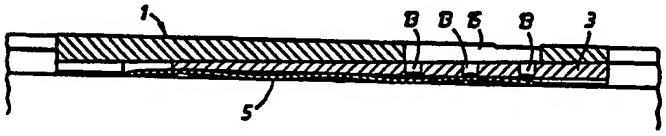

Fig.2b

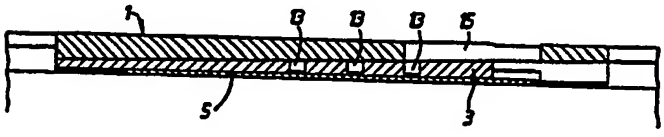

Fig.2c

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

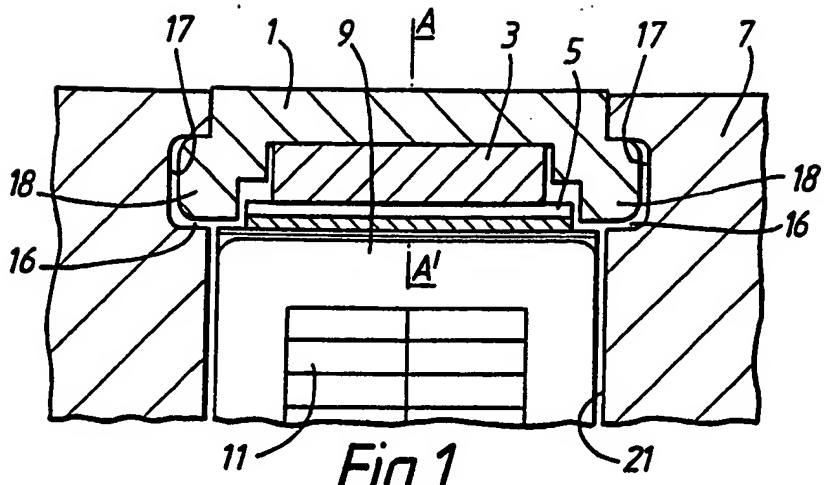

Fig. 1

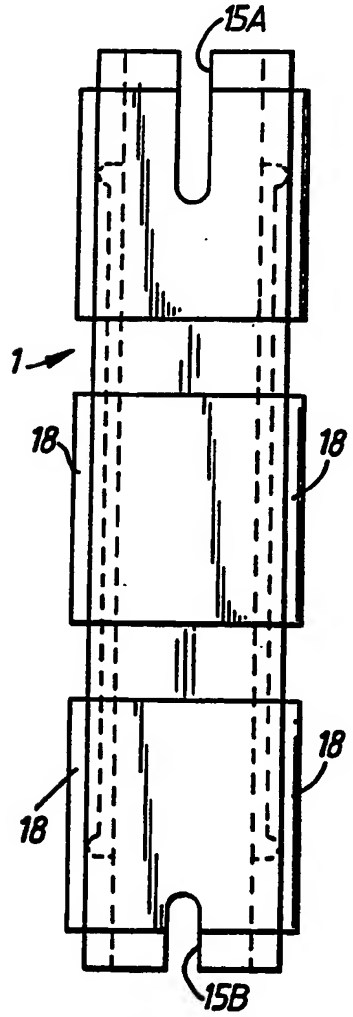

Fig. 4

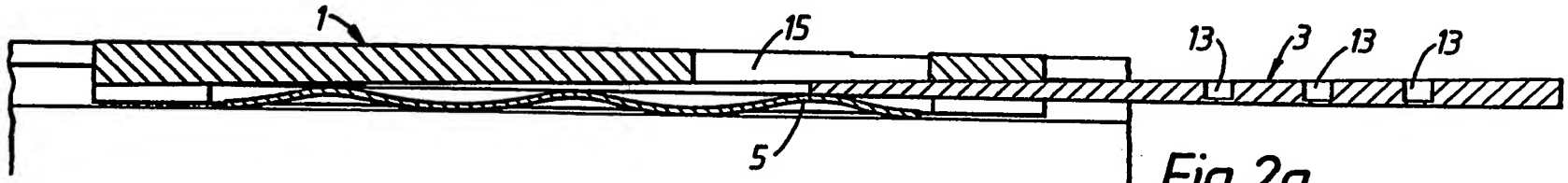

Fig. 2a

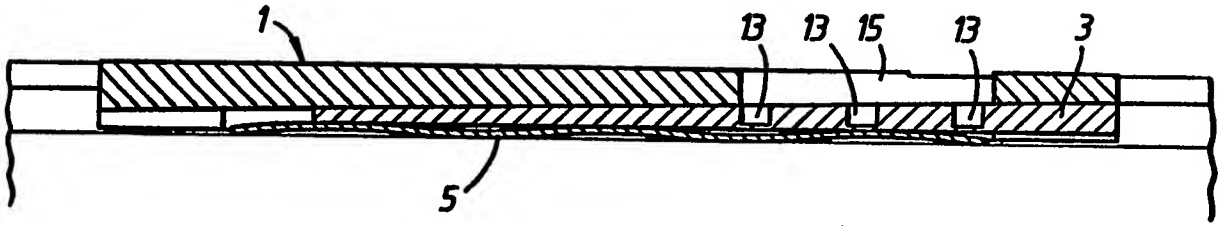

Fig. 2b

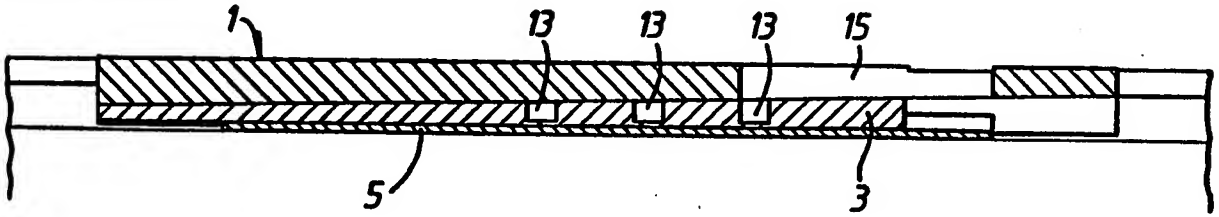

Fig. 2c

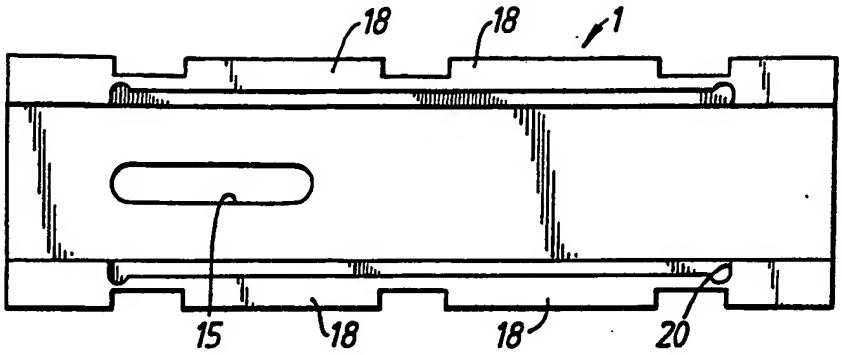

Fig.3a

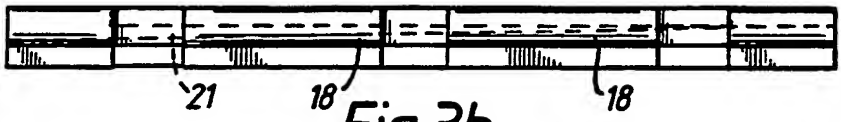

Fig.3b

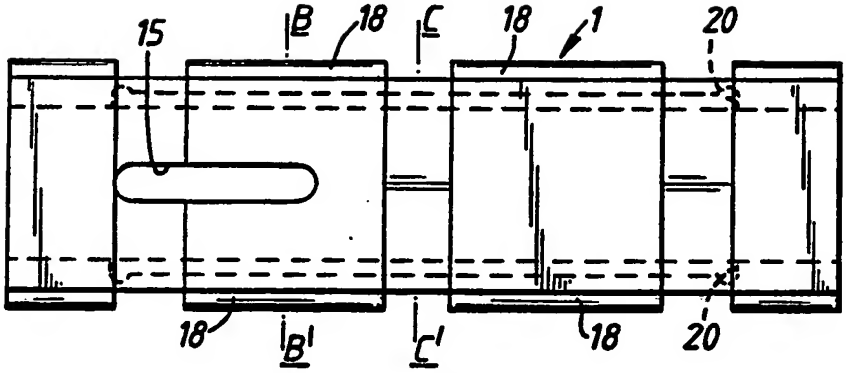

Fig.3c

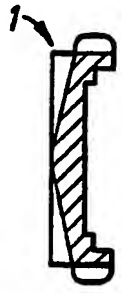

Fig.3d

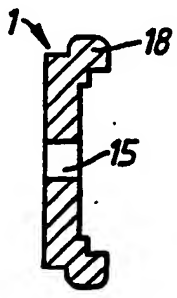

Fig.3e

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Electrical Machine Slot Wedging System

This invention relates to electrical machine slot wedging systems, more particularly, to systems for wedging electrical conductors in slots formed in the stators or rotors of electrical machines.

The current-carrying conductors forming the windings of a stator or rotor are commonly embedded in axially extending slots in the periphery of the stator or rotor.

It is important that the conductors should be a fairly tight fit in the slots so that heat can travel from the conductors through the slot insulation to the walls of the slots and vibration of conductors in the slot is minimised. To hold the conductors and slot insulation in position, the slot openings are sealed by wedges, which also serve to oppose centrifugal forces where the slots are formed in a rotor.

Although it is known to use a single elongate wedge to seal an entire slot, where the slot is very long, it is more usual to seal the slot with a plurality of short elongate wedge sections extending along the opening. Commonly a single length of ripple spring runs underneath all the wedge sections to provide resilience.

It is often difficult to ensure that the loading on each of the wedge sections is even, so that the conductors are held securely in the slot. The pressure exerted by a wedge section generally reduces with time due to vibration-induced fretting and bedding-in of packing and reduction in effect of resilient components, if fitted, so that it is necessary to tighten the wedging, either by providing extra packing, or by replacing the wedge sections. This procedure is both time-consuming and inconvenient, particularly as it is frequently necessary to destroy part of the wedge section as part of the procedure.

As an alternative to a wedge formed from a single piece of material, a wedge may comprise two tapered wedge members, tapered in the direction of the length of the slot; in use one of the wedge members is placed within the slot and the other wedge member is driven between the first wedge member and the packing surrounding the conductor(s) contained within the slot. Once the second wedge member is driven completely underneath the first wedge member, it is difficult to drive the second wedge member further in the same direction and thus further tightening cannot be achieved very easily.

It is an object of the present invention to provide electrical machine slot wedging systems in which the above problems are overcome.

According to a first aspect of the invention there is provided an electrical machine slot wedging system comprising a ripple spring sandwiched between a wedge means and a conductor in the slot characterised in that the wedge means comprises two co-operating elongate wedge members which taper in opposite directions along the length of the slot.

According to a second aspect of the invention there is provided an electrical machine slot wedging system comprising a plurality of separate wedge sections axially aligned along the length of the slot each section comprising resilient means sandwiched between a wedge means and a conductor in the slot.

According to the third aspect of the invention there is provided an electrical machine slot wedging system comprising resilient means sandwiched between a wedge means and a conductor in the slot, the wedge means being retained within the slot by retaining means, which allow said wedge means to be urged further into said slot so as to determine the force exerted by said resilient means.

Preferably, the retaining means comprises a projection and a co-operating recess, one of which is formed on a wall of said slot and the other of which is formed on said wedge means, said recess having a greater dimension in the direction of the length of the slot than said projection.

According to a fourth aspect of the invention there is provided an electrical machine slot wedging system comprising resilient means sandwiched between a wedge means and a conductor in the slot, the wedge means comprising first and second co-operating wedge members which taper in opposite directions along the length of the slot characterised in that the outer said wedge member has an aperture formed therein to permit insertion of a tool via the aperture to drive the other wedge member under the outer wedge member.

One electrical machine slot wedging system in accordance with the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a cross-sectional view of a stator slot and an assembled slot wedging system within the slot

Figure 2a, 2b, and 2c are sectional views along the line A-A' in Figure 1 at various stages of the assembly of the wedging systems

Figures 3a, 3b, and 3c are a bottom view, side view and top view of a main wedge member of the system and Figures 3d and 3e are cross-sections along lines C-C' and B-B' of Figure 3c respectively

Figure 4 is a top view of an alternative embodiment of the main wedge member.

As shown in Figure 1, conductors 11 of a winding are positioned within an axial slot 21 formed in a stator core 7. An insulated stack of conductors of rectangular cross-section 11 is retained within the slot 21 by means of packing material 9 and a plurality of wedge sections (only one of which is shown) axially aligned along the length of the slot 21, typically thirty sections along a slot.

Each wedge section comprises a main wedge member 1, a drive wedge member 3 and a ripple spring 5.

The drive wedge 3 and main wedge 1 are tapered along the length of the slot 21 in opposite directions.

The main wedge 1 is retained within the slot by means of co-operating grooves 17 formed in the slot walls and projections 18 on the sides of the main wedge 1.

As can be seen in Figure 1, the projections 18, grooves 17 and packing material 9 are dimensioned so that there is a gap 16 between each projection 18 and the base of the groove 17, on either side of the assembled wedge section. This permits a monitoring device to be used to depress the section until the projection 18 abuts the base of the groove 17, thereby measuring the loading of the system due to the resilient ripple spring 5. In this way the loading of each wedge section can be individually monitored, in situ.

The combination of a ripple spring 5 with wedge members 1, 3 forms a wedge section which can be assembled particularly rapidly and easily.

To assemble a wedge section of the system, the ripple spring 5 is placed in a recess 23 of the main wedge 1 shown in Figure 3a. The main wedge 1 is then inserted into the open ends of the grooves 17 of the slot 21, carrying with it the ripple spring 5.

The main wedge 1, with its ripple spring 5 is moved along the slot 21 to the required position.

As shown in Figure 2a, the drive wedge 3 is then inserted, narrow end first, between the ripple spring 5 and the main wedge 1.

The drive wedge 3 flattens the ripple spring 1 against the packing material 9 and insulated conductors 11 so that it holds them resiliently in place.

The main wedge 1 is dimensioned as shown in Figure 3 so that the ripple spring 5 does not move substantially axially as the drive wedge 3 is inserted but is held in place by the corners 20 of the recess 23.

On initially assembling the system, each drive wedge 3 is driven into the position shown in Figure 2(b) by exertion of pressure at the exposed thick end of the drive wedge 3.

If a conductor, whilst the machine is in service, becomes loose in the slot 21 it may be tightened by driving the drive wedge 3 further under the main wedge, towards the position shown in Figure 2(c). This can be achieved by means of a tool inserted through an aperture 15 in the associated main wedge 1 into an appropriate one of several indentations 13 provided in the adjacent surface of the drive wedge 3. It will be appreciated that this allows adjustment without removal of the wedge section from the slot 21, the ends of the drive wedges 3 being inaccesible once the plurality of sections are assembled within the slot 21.

Figure 2(c) shows the drive wedge 3 inserted to its fullest possible extent. One of the indentations 13 is still accessible via the aperture 15 to facilitate removal of the drive wedge 3 from the main wedge.

In a modification of the main wedge 1 shown in Figure 4, aperture 15 is replaced by an aperture 15A at the end of the main wedge 1. Thus the aperture 15A has the form of an open slit. The aperture 15A allows the user to impel the drive wedge 3 merely by applying a force to the thick end of the wedge 3 using an instrument inserted via aperture 15A, thus rendering the indentations 13 unnecessary. In this way the user can continue to push the drive wedge 3 further under the main wedge 1 after the thick end of the drive wedge 3 becomes flush with the end of the main wedge 1.

Since the wedging sections are positioned end-to-end in the slot 21, it is advantageous to provide a further aperture 15B at the other end of the main wedge 1 so as to facilitate manipulation of a tool in the corresponding aperture 15A of the main wedge 1 of the next wedge section in the slot. The aperture 15B also allows the user to push an inserted drive wedge 3 out of the main wedge 1 if it is desired to take the wedging system apart.

Although in the embodiment described, the main wedge 1 is retained within the slot 21 by means of grooves on the slot wall co-operating with projections in the main wedge 1, it will readily be seen that this arrangement could be reversed.

CLAIMS

1. An electrical machine slot wedging system comprising a ripple spring sandwiched between a wedge means and a conductor in the slot characterised in that the wedge means comprises two co-operating elongate wedge members which taper in opposite directions along the length of the slot.

2. A system as claimed in Claim 1 wherein one said wedge member includes a recess for retaining said ripple spring in position with respect to said one wedge member.

3. An electrical machine slot wedging system as claimed in Claim 1 substantially hereinbefore described and illustrated in Figures 1, 2 and 3 or 1, 2, and 4.

4. An electrical machine slot wedging system comprising a plurality of separate wedge sections axially aligned along the length of the slot and each section comprising resilient means sandwiched between a wedge means and a conductor in the slot.

5. A system as claimed in Claim 4 wherein said resilient means is a length of ripple spring.

6. A system as claimed in Claim 4 or 5 wherein said wedge section comprises two co-operating elongate wedge members which taper in opposite directions along the length of the slot.

7. An electrical machine slot wedging system comprising resilient means sandwiched between a wedge means and a conductor in the slot, the wedge means being retained within the slot by

retaining means, which allow said wedge means to be urged further into said slot so as to determine the force exerted by said resilient means.

8. A system as claimed in Claim 7 wherein said resilient means is a ripple spring.

9. A system as claimed in Claim 7 or 8 wherein said retaining means comprises a projection and a co-operating recess, one of which is formed on a wall of said slot and the other of which is formed on said wedge means, said recess having a greater dimension in the direction of the depth of the slot than said projection.

10. A system as claimed in any of Claims 7 to 9 wherein said wedge means comprises two co-operating elongate wedge members, which taper in opposite directions along the length of the slot.

11. An electrical machine slot wedging system as claimed in Claim 7 substantially as hereinbefore described and illustrated in Figures 1, 2 and 3 or 1, 2 and 4 of the accompanying drawings.

12. An electrical machine slot wedging system comprising resilient means sandwiched between a wedge means and a conductor in the slot, the wedge means comprising first and second co-operating wedge members, tapered in opposite directions along the length of the slot characterised in that the outer said wedge member has an aperture formed therein to permit insertion of a tool via the aperture to drive the other wedge member under the outer wedge member.

13. A system as claimed in Claim 12 wherein said other member has an indentation into which a tool is insertable via the aperture.

14. A system as claimed in Claim 13 wherein said aperture is formed in one end of the outer wedge member.

15. A system as claimed in Claim 12, 13 or 14 wherein said resilient means is a ripple spring.

16. An electrical machine slot wedging system as claimed in Claim 12 substantially as hereinbefore described and illustrated in Figures 1, 2 and 3 or 1, 2 and 4 of the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
GB 9213979.9

Relevant Technical fields

(i) UK Cl (Edition K) H2A AKF1A

(ii) Int Cl (Edition 5) H02K 03/493, 03/487

Search Examiner
J COCKITT

Databases (see over)
(i) UK Patent Office

(ii)

Date of Search
13 OCTOBER 1992

Documents considered relevant following a search in respect of claims 1-16

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 1430756 A (REYROLLE) - see figure 4	Claims 1 4-6 at least

Category	Identity of document and relevant passages	Relevan to claim(s)

Categories of documents

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